



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/783,498	02/20/2004	Li-Shyue Lai	TSM03-0199	7579
43859	7590	01/13/2006	EXAMINER	
SLATER & MATSIL, L.L.P. 17950 PRESTON ROAD, SUITE 1000 DALLAS, TX 75252			CAO, PHAT X	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 01/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

H:A

**Office Action Summary**

Application No.

10/783,498

Applicant(s)

LAI ET AL.

Examiner

Phat X. Cao

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☒ This action is **FINAL**.      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-11 and 29-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-11 is/are allowed.
- 6) ☒ Claim(s) 1-8 and 29-38 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |  |
|--|--|
| <p>1) <input type="checkbox"/> Notice of References Cited (PTO-892)</p> <p>2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</p> <p>3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br/>Paper No(s)/Mail Date <u>12/19/05</u>.</p> | <p>4) <input type="checkbox"/> Interview Summary (PTO-413)<br/>Paper No(s)/Mail Date. _____.</p> <p>5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)</p> <p>6) <input type="checkbox"/> Other: _____.</p> |
|--|--|

### **DETAILED ACTION**

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn. Applicant's submission of an information disclosure statement on 12/19/05 prompted the new final rejection presented in this Office action. See MPEP 609.04(b).

### ***Claim Objections***

2. Claim 7 is objected to because of the following informalities:

In claim 7, line 3, a phrase "or below the lower surface of the dielectric layer" should be changed to "or below the **upper** surface of the dielectric layer" because Fig. 5E shows the phase change material layer 116 formed below the upper surface of the dielectric layer 170, but not below the lower surface of the dielectric layer 170.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-8 and 29-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ha et al (cited in IDS) in view of Lowrey (US. 6,673,648).

Regarding claims 1, 8, 29 and 30, Ha (Figs. 1b and 4) discloses a phase change memory cell comprising: an insulating dielectric layer ILD; a thin conductive film BE having a first film thickness on the dielectric layer ILD, the plane of the film BE being

Art Unit: 2814

generally parallel to the plane of the dielectric layer ILD; a layer of a phase change material GST (see page 175, column 1, last paragraph) having a second film thickness supported by the dielectric layer ILD; and an electrically resistive interface between the thin conductive film BE and the phase change material layer GST, the interface being defined by an area of engagement between the film BE and the layer GST that is generally normal to the plane of the dielectric layer ILD, and wherein the thickness of the thin conductive film BE is less than the thickness of the layer of phase change material GST at the interface.

Ha does not disclose that the phase change memory cell is formed on a semiconductor substrate.

However, Lowrey (Fig. 3) teaches a phase change memory cell 10 formed on a semiconductor substrate 28 and electrically connected to an output of a transistor 22. Accordingly, it would have been obvious to form the phase change memory cell of Ha on the semiconductor substrate because such forming of the semiconductor substrate is commonly used for supporting the memory cell, and for providing the electrical contacts between the phase change memory cell and the electronic components such as transistors, as taught by Lowrey's Fig. 3.

Regarding claims 2-3, 5, 33 and 35, Ha's Fig. 1b further discloses that the width of the conductive film BE generally parallel to the plane of the dielectric layer ILD and the height of the conductive film BE generally normal to the plane of the dielectric layer ILD determine the area of engagement (claims 2-3 and 35). Therefore, the current path from the interface into the phase change material layer GST inherently lies in a direction

substantially parallel to the plane of the substrate, and the current path from the phase change material layer GST into the upper contact (not labeled) inherently lies in a direction generally normal to the plane of the substrate (claims 5 and 33).

It is noted that the electrical resistance of the interface is inversely proportional to the area of engagement (claims 2) because the conductive resistance is inversely proportional to the conductive area. It is also noted that the process limitations recited in a "product by process" claims 3 and 35 (determined by photolithography, by deposition parameters) would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 4 and 32, because the width of the conductive film BE is parallel to the plane of the substrate, the heat produced by current through the interface would also flow from the interface into the phase change material layer GST in a direction parallel to the plane of the substrate.

Regarding claims 6 and 31, Ha's Fig. 1b further discloses that the phase change material layer GST and the thin conductive film BE are not relatively superjacent or subjacent, and the conductive material BE comprises a high band gap and high thermal conductivity material of titanium nitride (page 175, column 1, last paragraph).

Regarding claims 7 and 34, Ha's Fig. 1b further discloses that the phase change material layer GST resides in a trench formed in the dielectric layer ILD, the bottom surface of the trench and the phase change material layer GST being below the upper surface of the dielectric layer ILD.

Regarding claim 36, Ha (Figs. 1b and 4) discloses a memory cell, comprising: a layer of phase change material GST; and an elongated thin conductive film BE having one end engaging a side of the layer GST to define an interface having a width and a height, wherein the thin conductive film and the layer of the phase change material GST engage at an interface and wherein the thin conductive film BE has a thickness at the interface that is thinner than the phase change material GST at the interface. It is also noted that the process limitations recited in a "product by process" claim (determined non-photolithographically, by thin film deposition parameters)) would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 37-38, because the width of the conductive film BE generally parallel to the plane of the substrate and the height of the phase change material layer GST generally normal to the film BE, the current flows from the interface into the phase change material layer GST generally parallel to the film BE and the current flows out of the layer GST generally normal to the film BE.

***Allowable Subject Matter***

5. Amended claims 9-11 are allowed.

See reasons of record.

***Response to Arguments***

6. Applicant's arguments filed 12/19/05, with respect to the rejection(s) of claim(s) 1-8 and 29-38 have been fully considered and are persuasive. Therefore, the rejection

has been withdrawn. However, upon further consideration, a new final ground(s) of rejection is made in view of the new reference cited in the IDS filed on 12/19/05.

***Conclusion***

7. **Applicant's submission of an information disclosure statement** under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 12/19/05 prompted the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609.04(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2814

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PC  
January 9, 2006

  
PHAT X. CAO  
PRIMARY EXAMINER